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SYNOPSSES OF NORTH AMERICAN INVERTEBRATES.

XXI. THE NEMERTEANS.

WESLEY R. COE.

PART I.

SPECIES OCCURRING ON THE WEST AND NORTHWEST COASTS OF NORTH AMERICA.¹

THE Nemerteans embrace a highly specialized group of flatworms, the most characteristic features of which are the soft extensible body without indication of external segmentation, the highly developed eversible proboscis, the straight intestine, opening at the posterior end of the body, and the absence of any distinct body cavity.

The body is commonly long, flattened, and ribbon-like (Cerebratulus), filiform (Cephalothrix, Lineus), broad and flat (Drepanophorus), thick and rounded (Euborlasia), or short and cylindrical (Tetrastemma), but in nearly all forms is extremely extensible and may often be contracted to one tenth the length of the fully extended worm. In size there is the greatest variation found in any group of worms, for there are minute species (Tetrastemma) but 5 mm. long and a half millimeter thick when sexually mature, while another (*Lineus longissimus*) may become

¹ Of the 87 species which have thus far been recorded from the west and northwest coasts, only 19 are known to occur on the east coast of North America or in other regions of the globe. Because of this geographical limitation of the species it seems desirable to divide the synopsis of North American Nemerteans into two parts, the first to include those forms which have been collected on the west coast between Panama and the Arctic Ocean, the second to embrace the Atlantic species. This plan seems particularly desirable inasmuch as the diagnostic characters are necessarily based to a considerable extent on anatomical peculiarities, which have been somewhat more fully studied in the Pacific species than in those from the east coast of North America.

25 meters in length when fully extended, but remains as slender as a thread; still another (*Cerebratulus lacteus*) grows to be 7 meters long and 20 mm. wide, while the single known individual of *Euborlasia maxima* was 45 mm. in width after preservation.

Although the body is without external segmentation, many of the internal organs are metamerically arranged. The body is covered throughout with glandular and ciliated epithelium. A true body cavity being wanting, the space between the muscular walls of the body and the intestine is filled with gelatinous tissue, or parenchyma. Many species of the Heteronemertea have a delicate caudal cirrus beneath the anal opening at the posterior end of the body, and the representatives of a single genus (*Nectonemertes*) are provided with a pair of lateral swimming appendages near the anterior end of the body.

The proboscis is bathed in a corpusculated fluid, enclosed in a special muscular sheath, and opens at the anterior end of the body, sometimes in connection with the mouth and sometimes separately. In many species it is nearly as long as the body itself; it is lined with glandular epithelium, and in certain genera is provided with rhabdites or nematocysts. In one of the four orders (Hoploneurtea) there are highly specialized calcareous stylets of such definite size and shape that they form most convenient and reliable diagnostic features.

The mouth is situated anteriorly, either in front of the brain, as in the Hoplonemertea, or immediately behind it, as in the other two orders. The mouth leads into the esophagus, which is often demarcated from the succeeding portion, the stomach; the latter opens into the intestine, which in most genera is provided with paired lateral diverticula. In the Hoplonemertea the stomach is prolonged into a narrow tube, pylorus, which opens well back of the anterior end of the intestine, the latter thus extending forward beneath the pylorus as the intestinal cæcum. Other appendages occur in certain species.

The blood circulates in two or three longitudinal vessels, which usually have numerous anastomoses and open into one or more large lacunæ in the head.

The excretory organs, or nephridia, usually consist of a pair of lateral canals, the ramifications of which lie in close relation

with the blood vessels in the esophageal region. One or more efferent ducts lead from each main canal to the exterior of the body or, in rare instances, to the esophagus.

The muscular system consists of either two or three strong layers of fibers, the arrangement of which forms a convenient diagnostic character and is described in the key to the orders. In some forms there are additional secondary layers.

The relative position of the principal nerve cords with respect to the muscular layers is likewise of primal importance in classification. The central nervous system consists of a four-lobed brain, the two lobes of each side being closely united with each other and joined to those of the other side by a commissure above and one below the rhynchodæum, and a pair of large lateral nerves, accompanied by ganglion cells, extending from the ventral pair of brain lobes to the posterior end of the body. In addition, a dorso-median nerve is commonly present, and sometimes a ventro-median one; most forms have a pair of well developed esophageal nerves, and nearly all have special proboscis nerves, together with peripheral nerves to the integument, ocelli and other sense organs. In most forms a pair of highly specialized cerebral sense organs lie in close proximity to the dorsal brain lobes, with which they are completely fused in the *Heteronemertea*. A pair of lateral sense organs occur on the lateral margins of the body in the nephridial region in many *Paleonemertea*; frontal sensory pits are found on the tip of the snout in many forms, while *Carinoma* has a number of sensory pits on the dorsal aspect of the head. Ocelli are often present in considerable numbers, but are wanting in the *Paleonemertea* and in many species of the *Heteronemertea*.

The sexes are separate in most species, although a few are hermaphroditic. The sexual products develop in simple sacs in the body parenchyma and are discharged directly upon the surface of the body. Where lateral intestinal lobes are developed the gonads often alternate with them with much regularity.

In the larval development, some forms (*Lineidæ*) pass through a complicated metamorphosis, with the formation of a free-swimming larva of highly specialized form (pilidium, or Desor's larva),

but in other forms (*Amphiporus*, *Cephalothrix*) development is direct, or is accompanied only by a shedding of the larval integument.

Nearly all species are marine, living under stones, among algæ, or in burrows in the sea bottom or shore between tides; representatives of a single widely distributed genus (*Stichostemma*) live in fresh-water pools, ponds, or rivers, and several species live in moist earth in warm climates; a few forms are commensal, inhabiting the mantle chambers of pelecypods or of ascidians, while the members of a single genus (*Carcinonemertes*) are truly parasitic, living among the gill plates or egg masses of various species of crabs.

All Nemertean may be conveniently arranged in four orders, comprising more than thirty genera and several hundred species. Of these, 21 genera with 87 species have been recorded from the Pacific coast, the Nemertean fauna of that region being more abundant and more diversified than in almost any other locality of equal extent.

For convenience in determination, the 87 species at present known from the west and northwest coasts of North America, from Panama to the Bering Sea and Arctic Ocean, may be arranged in the following analytical keys, based mainly on superficial and easily distinguishable characters.

The first key embraces the orders; under each order is given a key to those genera known to occur in the region designated, and under each genus the species there represented.

The geographical distribution, so far as it is known at present, of each of these species is indicated in the keys to species by the following abbreviations:—

- N. Arctic Ocean north of Bering Strait.
- B. Bering Strait, Bering Sea, Aleutian Islands, Commander Islands.
- A. Pacific coast of Alaska.
- P. Puget Sound and British Columbia.
- C. Central and northern California; Monterey Bay.
- S. Southern California; San Pedro and San Diego.
- E. Gulf of California and southward to equatorial regions.
- X. Eastern coast of North America.
- Y. European waters.

A prime mark (') indicates that the species occurs in deep water off the corresponding coast; the figures following indicate depth in fathoms.

KEY.

1. Without sucking disk ; intestine not convoluted.
 2. Proboscis without stylets ; mouth posterior to brain ; intestinal cæcum absent.
 3. Muscular walls of body in two layers—outer circular and inner longitudinal—to which a third—inner circular—is sometimes added ; lateral nerves either outside muscular layers or imbedded in longitudinal muscles ; cutis absent . . . **Paleonemertea.**
 - 3¹. Muscular walls of body in three main layers of which the inner is longitudinal ; lateral nerves outside circular muscular layer ; cutis well developed **Heteronemertea.**
 - 2¹. Proboscis usually provided with stylets ; mouth in front of brain, usually opening with proboscis in a single terminal or subterminal pore ; intestinal cæcum usually present ; lateral nerves internal to muscular layers of body walls **Hoploneurertea.**
- 1¹. With sucking disk at posterior end of body ; intestine convoluted **Bdellonemertea.**

Order **Paleonemertea.**

1. Paired intestinal diverticula absent **2.**
1. Paired intestinal diverticula present **3.**
2. Lateral nerves situated immediately outside circular muscles of body walls **CARINELLA.**
2. Lateral nerves situated outside muscular layers in esophageal region, but imbedded in longitudinal muscles behind nephridial region ; intestine lobed, but without regularly paired diverticula ; cerebral sense organs wanting **CARINOMELLA.**
3. Internal circular muscles enormously developed in nephridial region ; mouth situated immediately behind brain ; body not very slender ; head broader than neck ; nephridia well developed . . . **CARINOMA.**
3. Internal circular muscles but little developed in any portion of body ; mouth situated far behind brain ; body filiform ; head sharply pointed **CEPHALOTHRIX.**

CARINELLA.

1. Body of somewhat homogeneous color, without definite markings . . . **2.**
1. With distinct longitudinal or transverse markings, or both . . . **3.**
2. Body very soft, attaining a length of upwards of 2 meters when fully extended ; deep red, orange, or bright vermilion *C. rubra* Griffin, B, A.
2. Body minute, very slender ; whitish and somewhat translucent *C. pellucida* Coe, C, S, X.

3. Yellow, rosy, or greenish, with black longitudinal and transverse markings. Body large, rather firm, only moderately slender, attaining a length of 50 cm. or more; pale yellowish or rosy, sometimes with greenish tinge, with 3 longitudinal velvety black lines and a series of narrow rings of similar color *C. frenata* Coe, S.
3. Red or brown, with white markings 4.
4. Deep red, with a series of narrow white rings, but without longitudinal lines. Body firm, rather stout, upwards of 30 cm. long; deep red, with a series of narrow white rings placed at frequent intervals throughout body *C. albocincta* Coe, S.
4. Brown, with longitudinal and transverse white markings 5.
5. With 3 longitudinal white lines. Slender, up to a meter in length; brown, with numerous narrow transverse rings and 3 parallel longitudinal white lines, of which one is in the dorso-median line and one just below each lateral margin *C. capistrata* Coe, A, C.
5. With 4, 5, or 6 longitudinal white lines 6.
6. Body slender, subcylindrical, 15 cm. or more in length; deep brown, with a series of white rings and 4 longitudinal white lines, of which 2 are lateral, while the other 2 divide dorsal surface of body into three equal parts *C. cingulata* Coe, C.
6. Body slender, subcylindrical, often half a meter or more in length when fully extended; brown or chocolate, with numerous narrow transverse rings and 5 or 6 parallel longitudinal white lines, of which one is in the median dorsal line, two on each lateral surface, and the sixth, when present, is usually merely indicated in the ventro-median line
C. sexlineata Griffin, A, P, C, S.

CARINOMELLA.

Body slender, usually 5 to 10 cm. in length; milk-white and somewhat translucent, sometimes with yellowish or brownish intestinal canal

C. lactea Coe, S.

CARINOMA.

Body rather stout, flattened posteriorly; milk-white with grayish or brownish mottlings and darker intestinal lobes

C. mutabilis Griffin, P, C, S.

CEPHALOTHRIX.

Slender, filiform; pale yellow, sometimes with reddish, grayish, or greenish tinge; no ocelli in adult

C. linearis (Rathke) Oersted, B, A, P, C, S, X, Y.

Order **Heteronemertea.**

1. Proboscis musculature of two layers, of which the outer is circular ; muscular crosses absent in proboscis ; cephalic glands usually very voluminous, extending posteriorly behind the brain ; cephalic furrows absent **TÆNIOSONA.**
1. Proboscis musculature of two or three layers, of which the outer is longitudinal : muscular crosses present in proboscis ; cephalic glands usually but little developed, and not extending posterior to brain **2.**
2. Without horizontal cephalic furrows on sides of head ; caudal cirrus present **ZYGEPOLIA.**
2. With conspicuous horizontal cephalic furrows on sides of head **3.**
3. Caudal cirrus absent ; proboscis sheath usually considerably shorter than body **4.**
3. Caudal cirrus present ; proboscis sheath usually extends nearly or quite to posterior end of body **5.**
4. Body remarkably thick and massive, usually nearly cylindrical when fully extended, but very broad and much flattened in intestinal region when strongly contracted ; ocelli wanting ; muscular layers of body possess a reddish tinge **EUBORLASIA.**
4. Body long and slender, rounded or flattened, very contractile : ocelli present in most species **LINEUS.**
5. Body rather firm, lateral margins not remarkably thin ; incapable of swimming ; neurochord cells absent in many species **MICRURA.**
5. Body usually long and ribbon-like, much flattened, with very thin lateral margins and well adapted for swimming ; dorso-ventral and diagonal muscles well developed ; neurochord cells present in many species **CEREBRATULUS.**

TÆNIOSONA.

1. With narrow transverse rings of white throughout length of body. Body of moderate diameter, but of great length, often exceeding 2 meters, somewhat flattened ; brown, with a great number of narrow rings of whitish encircling the body *T. mexicana* Bürger, E.
1. Without white rings **2.**
2. Yellow, thickly sprinkled with small, irregular, dark red spots ; body of very large size, sometimes 2 meters or more in length and 18 mm. in diameter *T. princeps* Coe, A, P.
2. Deep red, mahogany, or reddish brown, sometimes covered with whitish bloom ; head with broad spot of darker color and terminal border of white ; ventral surface of same general color as dorsal, but paler, except ventral side of head, which is whitish ; body large, soft, flabby, 40 to 60 cm. in length *T. punnetti* Coe, C, S.

ZYGEUPOLIA.

Slender, 5 to 10 cm. in length; head acutely pointed; cephalic furrows absent, the canal from each cerebral sense organ opening into a small pit on side of head; caudal cirrus conspicuous; whitish or flesh-color, becoming yellowish, rosy, or pale brown in intestinal region and pure white on head. *Z. littoralis* C. B. Thompson, S, X.

EUBORLASIA.

Of gigantic size for a worm, with a greater diameter than in any other described species of Nemertean, becoming 45 mm. wide in intestinal region; dark brown, perhaps with an olive tinge; head paler, with brown mottlings *E. maxima* Coe, E.

LINEUS.

1. Snout and body not strikingly different in color; without distinct markings 2.
1. Snout and body of different color, or with distinct markings on body 3.
2. Dusky or brownish green, dark brown, or reddish brown, commonly paler beneath; a single row of 4 to 8 ocelli on each side of head
L. viridis (Fabr.) Johnston, A, X, Y.
2. Yellowish, pale yellow with tinge of orange, dull orange, ochre, buff, or yellowish brown; margins of head pale or colorless; with 3 to 7 irregular red, purple, or black ocelli, of which the most anterior are largest
L. flavescens Coe, S.
3. With conspicuous median dorsal stripe, but without transverse markings.
Deep brown or olive, with median dorsal stripe of white or lemon yellow extending whole length of body and widening out on head to form a broad white marking *L. albolineatus* Coe, C, S.
3. Without conspicuous median dorsal stripe 4.
4. With one or more narrow transverse rings of paler color 5.
4. Without transverse rings of paler color. Pink, rosy flesh-color, or pinkish red, sometimes with tinge of blue; snout white both above and below, sharply marked off from rosy color of body; often with bluish tinge after preservation *L. rubescens* Coe, C, S.
5. With a single narrow whitish band on dorsal side of head, connecting posterior ends of cephalic furrows.
Body and head dark reddish brown or purple *L. torquatus* Coe, A.
5. With numerous delicate rings of white or yellowish 6.
6. Soft and flabby; deep brown, chestnut, or slaty, sometimes with green-

- ish tinge; with transverse lemon yellow rings at intervals along whole length of body and with 7 to 15 very inconspicuous, fine, hair-like longitudinal lines of yellow on dorsal surface; of these latter the median line is more distinct than the others and connects the diamond-shaped enlargements of the transverse rings; tip of snout white, usually with 2 orange colored spots *L. pictifrons* Coe, S, E.
6. Slender; deep brown, chocolate, or drab, paler beneath, with series of very narrow and inconspicuous white rings; tip of snout and borders of cephalic furrows white *L. wilsoni* Coe, C, S.

MICRURA.

1. With conspicuous transverse rings of white 2.
 1. Without conspicuous transverse rings 3.
 2. Deep purple or reddish brown above, with a series of narrow transverse rings throughout length of body; pure white beneath and on lateral margins of body; tip of snout deep orange or vermilion; caudal cirrus white, conspicuous *M. verrilli* Coe, A, P, C.
 2. Dusky gray above, with narrow colorless transverse bands; head flesh-colored *M. impressa* (Stimpson) Coe, B.
 3. Dorsal surface with conspicuous spots and blotches 4.
 3. Without distinct spots, except on tip of snout 5.
 4. Pale yellow, thickly covered on dorsal surface only with black or dark brown spots and dots, often somewhat elongated and arranged in irregular longitudinal lines; a single row of 10 to 18 ocelli on each side of head; nephridia limited to middle third of esophageal region; body rather stout, much flattened *M. pardalis* Coe, C.
 4. Grayish after preservation (color in life unknown), thickly mottled on both dorsal and ventral surfaces with coarse confluent brownish blotches, which often fuse together posteriorly to form a continuous brownish color; nephridia extend forward to mouth region
M. nebulosa Coe, A', 483.
 5. Rosy, flesh-color, or red; ocelli wanting 6.
 5. Olive, ochre, or buff; ocelli present.
- Pale olive brown, grayish ochre, or buff; deeper brown in intestinal region, and with a paler median dorsal stripe in esophageal region; 6 to 12 or more small black ocelli in an irregular row or elongated cluster on each side of head *M. olivaris* Coe, S, C', 68.
6. Deep red; tip of snout with black spot surrounded by narrow ring of white.
- Sometimes purplish in esophageal region and brighter red anteriorly; head bright red with a narrow, but very sharp and conspicuous, transverse band of white just behind tip of snout, which is red with a small, dark brown or black spot on the exact tip *M. nigrirostris* Coe, S.

6. Paler, without black spot on snout 7.
7. Rosy or pinkish red with purplish tinge in esophageal region, becoming gradually paler toward snout, which is white; intestinal region deep flesh-color, pale red, or yellowish; accessory buccal glands wanting

M. griffini Coe, S.

7. Salmon or flesh-color (rarely light, rosy brown); shading into lighter, with tinges of brighter red, or nearly white anteriorly; intestinal lobes more deeply colored, sometimes brown; a cream-colored stripe is situated in median ventral line; accessory buccal glands well developed

M. alaskensis Coe, A, C, S.

CEREBRATULUS.

1. Snout whitish both above and below, strikingly different from deep color of body 2.
1. Snout not strikingly different from body in color 3.
2. Body very long and ribbon-like, attaining a length of more than two meters; deep blood-red, except tip of snout, which is yellowish white, above and below *C. montgomeryi* Coe, B, A, P, B', 85.
2. Body long and ribbon-like, very dark brown or reddish purple, except head, which is white on both dorsal and ventral surfaces, back about three fourths the length of the cephalic furrows, or sometimes nearly or quite to the mouth *C. albifrons* Coe, A, P, C, S.
3. Without distinct longitudinal or transverse markings on body 4.
3. With conspicuous transverse or longitudinal markings on body 9.
4. Black, brown, reddish brown, olive, or dark gray, sometimes with paler lateral margins 5.
4. Rosy flesh-color, cream-color, or buff; head paler, brain and lateral nerves reddish and conspicuous in life, intestinal region cream-colored or pale buff; body remarkably fragile. *C. californiensis* Coe, S, S', 28.
5. Body long and ribbon-like 6.
5. Body comparatively short and broad 8.
6. Head very long and slender; nephridia with very numerous efferent ducts.

Dark brown or purplish, paler on borders of cephalic furrows and tip of snout; head and anterior portions of body very slender, with remarkably long and deep cephalic furrows *C. longiceps* Coe, A.

6. Head of moderate proportions, or short 7.
7. Slaty brown to grayish or pale olive, paler beneath and often with conspicuously paler or white lateral margins

C. marginatus Renier, A, P, C, S, X, Y.

7. Dark reddish brown; body very large and stout, becoming 2 meters or more in length and 25 mm. in width; head and cephalic furrows short

C. herculeus Coe, A.

8. Chestnut brown or reddish in esophageal region, chocolate brown pos-

teriorly; brownish flesh-color to reddish brown beneath, usually with median longitudinal ochre stripe along ventral surface

C. occidentalis Coe, A, P.

8. Brown or olive, ventral surface and lateral margins of body paler; body remarkably broad and much flattened, with very thin lateral margins; head very broad, with remarkably short cephalic furrows

C. latus Coe, A, B', A', P', C', 40-135.

9. Rather slender; pale gray with numerous fine, irregular and much interrupted dark olive brown longitudinal lines extending whole length of body both above and below, but more numerous and larger on dorsal surface than ventrally *C. lineolatus* Coe, S.
9. Rather short; with conspicuous narrow band of dark color in median dorsal line, and a series of narrow transverse markings of dark color placed side by side on dorso-lateral aspects of body. Other markings may possibly be present in life *C. signatus* Coe, B', 61.

Order Hoplonemertea.¹

1. Body provided with a pair of conspicuous lateral swimming appendages, or cirri, immediately back of head; posterior extremity broad and finlike; proboscis without stylets NECTONEMERTES.
1. Body without lateral appendages 2.
2. Proboscis sheath not more than three fourths the length of body; body long and slender 3.
2. Proboscis sheath extends nearly or quite to posterior end of body; body usually not very slender 6.
3. Proboscis sheath less than half the length of body; proboscis of small size 4.
3. Proboscis sheath one half to three fourths the length of body; proboscis well developed PARANEMERTES.
4. Accessory stylets present 5.
4. Accessory stylets absent; proboscis and sheath very rudimentary, with central stylet only; parasitic CARCINONEMERTES.
5. Ocelli minute and usually numerous EMPLECTONEMA.
5. Ocelli large, four in number; body filiform NEMERTOPSIS.
6. Proboscis provided with stylets, intestine not dendrocœlous 7.
6. Proboscis without stylets; intestine dendrocœlous; pelagic PLANKTONEMERTES.
7. Proboscis sheath without cœcal appendages; proboscis armed with single central stylet besides 2 or more pouches of accessory stylets 8.

¹ In addition to the marine Nemerteans here included, a representative of the fresh-water genus (*Stichostemma*) has been found in pools in the vicinity of Seattle, Washington.

7. Proboscis sheath provided with cæcal appendages; proboscis armed with central plate bearing a number of stylets besides several pouches of accessory stylets DREPANOPHORUS.
8. Ocelli numerous, extending posteriorly along lateral nerve cords beyond the brain; basis of central stylet massive, with flattened or concave posterior end ZYGONEMERTES.
8. Ocelli do not extend posteriorly beyond brain; basis of central stylet commonly (but not always) rounded posteriorly 9.
9. Body usually not very small; ocelli usually numerous, always more than 4 in the known Pacific coast species AMPHIPORUS.
9. Body very small; ocelli usually 4, arranged in rectangle; occasionally each of the four ocelli is double or fragmented into groups; rarely ocelli are entirely wanting TETRASTEMMA.

EMPLECTONEMA.

1. Dorsal surface green; central and accessory stylets curved; stylets long and slender; basis very long; body dark or pale green dorsally; whitish, yellowish, or very pale green ventrally

E. gracile (Johnston) Verrill, B, A, P, C, Y.

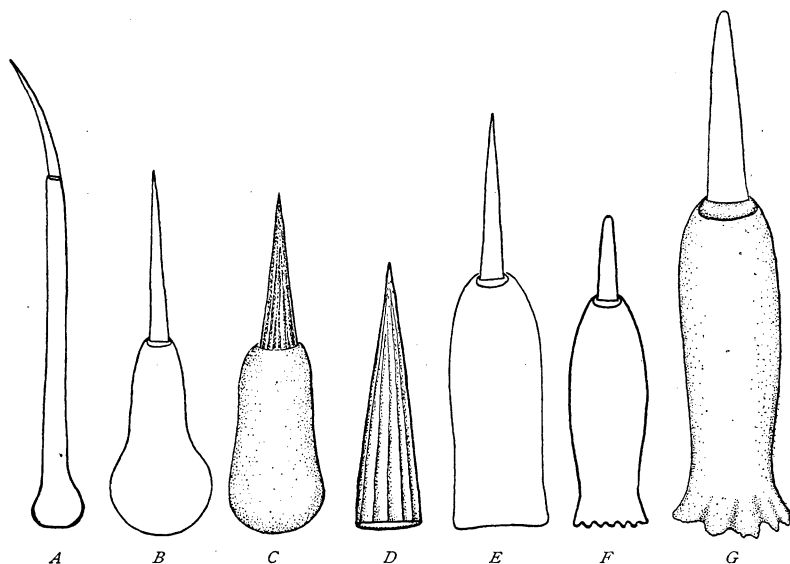


FIG. 1.—Outlines of central stylets and bases.

A, *Emplectonema gracile*.

B, *E. bürgeri*.

C, *E. purpuratum*.

D, *E. purpuratum*. Central stylet more highly magnified.

E, *Zygonemertes albida*.

F, *Z. thalassina*.

G, *Z. virescens*.

1. Dorsal surface brown or purplish ; central and accessory stylets straight 2.
2. Stylets short, with swollen heads ; basis of central stylet swollen and rounded posteriorly ; 11 proboscicial nerves ; dark brown above, often with minute purple dots ; flesh-colored or yellowish white beneath *E. bürgeri* Coe, A, P.
2. Stylets without swollen heads, fluted longitudinally ; basis of central stylet not swollen posteriorly ; 16 proboscicial nerves ; purplish or purplish brown from closely placed mottlings on dorsal surface ; ventral surface gray or yellowish *E. purpuratum* Coe, B.

NEMERTOPSIS.

Filiform, often 15 cm. or more in length ; very pale brown or whitish, with 2 longitudinal dorsal stripes of deep brown ; 8 proboscicial nerves

N. gracilis Coe, C.

CARCINONEMERTES.

Length when sexually mature but 4 to 6 mm. ; with 2 large ocelli ; orange or reddish ; parasitic on egg masses of *Epialtus productus* and perhaps other crabs *C. epialti* Coe, C.

PARANEMERTES.

1. White or flesh-color 3.
1. With orange, green, brown, or purple tints 2.
2. With 2 or 4 pouches of accessory stylets ; 14 proboscicial nerves ; stylets have braided appearance ; purplish brown, dark brown, or orange brown above, on sides, and on lateral margins of ventral surface ; with a whitish angular spot on each side of head ; ventral surface, often median third only, white or yellowish white *P. peregrina* Coe, B, A, P, C, S.
2. With 4 or 6 pouches of accessory stylets ; 10 large proboscicial nerves ; translucent ; pale orange anteriorly ; flesh-color, grayish, or very pale salmon posteriorly, much obscured by deep green color of intestinal tract *P. californica* Coe, S.
3. With 4 pouches of accessory stylets ; 9 or 10 proboscicial nerves ; opaque white *P. pallida* Coe, A.
3. With 6 or 12 pouches of accessory stylets ; 11 or 12 proboscicial nerves ; whitish, pinkish, or flesh-color *P. carnea* Coe, A, P.

ZYGONEMERTES.

1. Central stylet short and stout 2.
1. Central stylet rather slender.

Whitish, with tinge of yellow ; ocelli extend along lateral nerves for about two fifths the length of esophageal region ; body small

Z. albida Coe, P.

2. Pale green ; occasionally flesh-colored, pale yellow, or white, especially anteriorly ; central stylet short, about half as long as basis, not remarkably stubby ; usually 2 or 3 accessory stylets in each of 2 lateral pouches ; 10 or 11 proboscicial nerves

Z. virescens (Verrill) Montgomery, C, S, X.

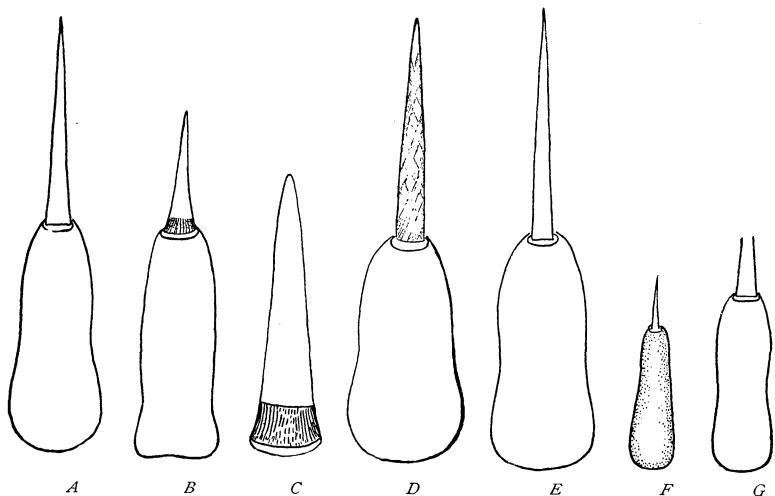


FIG. 2.—Outlines of central stylets and bases.

A, *Paranemertes carnea*.

B, *P. californica*.

C, *P. californica*. Stylet only, more highly magnified.

D, *P. peregrina*.

E, *P. pallida*.

F, *Carcinonemertes epialti*.

G, *Nemertopsis gracilis*.

2. Dark olive green ; central stylet remarkably stubby, often less than half as long as basis which is much serrated on posterior border ; commonly 5 accessory stylets in each of 2 lateral pouches ; 12 proboscicial nerves

Z. thalassina Coe, A.

AMPHIPORUS.¹

1. Body very gelatinous, with an enormous development of the body parenchyma.

Body short and broad ; ocelli large, 30 or more on each side of the head ; cerebral sense organs extremely small, situated in front of brain

A. gelatinosus Coe, A', 159.

¹ In addition to the forms here included, two species, *A. brunneus* and *A. drepanophoroides*, have been described by Griffin from Puget Sound, but their diagnoses are so incomplete that it is doubtful as to which, if any, of these forms they should be referred.

1. Body contains only a moderate amount of parenchyma 2.
2. Esophagus provided with large cæcum extending on ventral side of esophagus proper and ending blindly posteriorly 19.

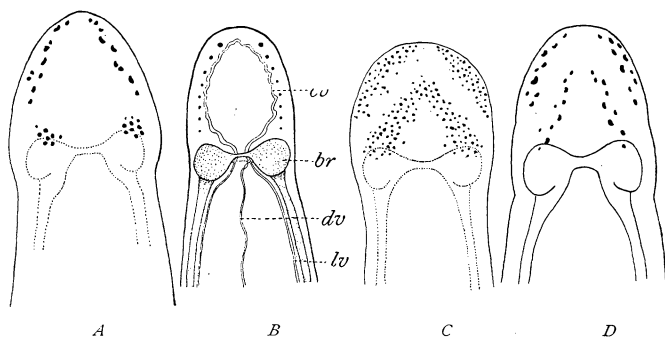


FIG. 3.—Outlines of heads, showing number and arrangement of ocelli.

A, *Paranemertes peregrina*.

B, *Amphiporus cruentatus*; br, brain; cv, dv, lv, cephalic, dorsal, and lateral vessels respectively.

C, *A. formidabilis*.

D, *A. imparispinosus*.

2. Esophagus without ventral cæcum 3.
3. Proboscis usually provided with only two pouches of accessory stylets 4.
3. Proboscis provided with more than 2 pouches of accessory stylets 16.
4. Ocelli in a single row on each side of head.

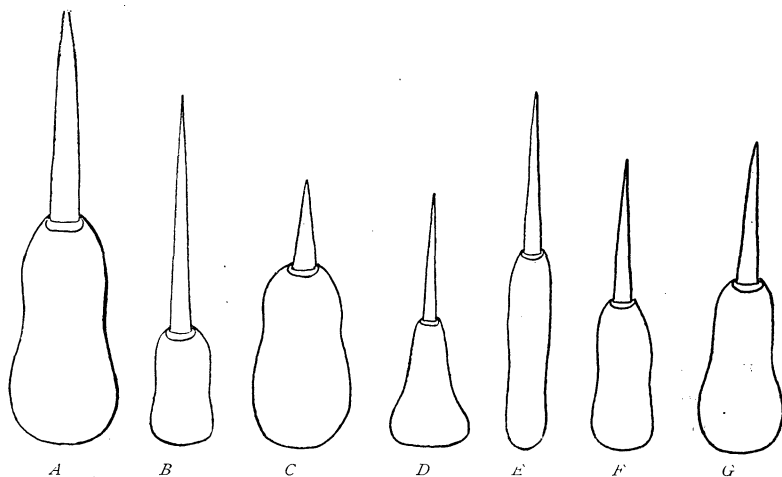


FIG. 4.—Outline of central stylets and bases.

A, *Amphiporus angulatus*.

B, *A. bimaculatus*.

C, *A. tigrinus*.

D, *A. nebulosus*.

E, *A. cruentatus*.

F, *A. similis*.

G, *A. imparispinosus*.

Body rather slender; 10 to 25 mm. in length; color yellow; blood vessels deep red in color; basis and stylet both very slender and of about equal length *A. cruentatus* Verrill, C, S, X.

4. Ocelli scattered, and not in a single row on each side of head¹ 5.
5. Central stylet as long as basis, or considerably longer 6.
5. Central stylet considerably shorter than basis 14.
6. Central stylet and basis of about equal length 8.
6. Central stylet about twice as long as basis 7.
7. Body rather broad and flattened; orange, brownish, or reddish above, with 2 large dark brown or black elongated spots on head; ventral sur-

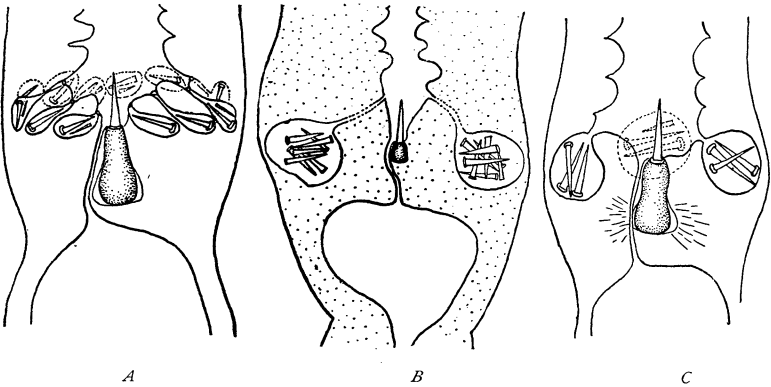


FIG. 5.—Outlines of stylet apparatus.

A, *Amphiporus formidabilis*, with 12 pouches of accessory stylets.

B, *A. punctatulus*, with 2 pouches of accessory stylets.

C, *A. imparispinosus*, with 3 pouches of accessory stylets.

face pale orange or flesh-color; sometimes with 4 pouches of accessory stylets; stylets very slender; 14 or 16 proboscisidial nerves; cerebral sense organs beside brain *A. bimaculatus* Coe, A, P, C.

7. Body rather short and thick; mottled thickly with dark brown dots and blotches; stylets dagger-shaped; 5 to 8 or more in each of the two lateral pouches; basis barrel-shaped; 12 or 13 proboscisidial nerves; cerebral sense organs large, situated beside brain

A. punctatulus Coe, S (at surface).

8. Cerebral sense organs in front of brain 9.
8. Cerebral sense organs beside brain.

Body short and broad; color reddish or brownish above, pale beneath;

¹ In a single species (*A. leptacanthus*) belonging to this group the relative length of stylet and basis is as yet unknown, and the species is not included in this key. Color of body whitish, with tinge of yellow or brown; basis of central stylet remarkably slender, four or five times as long as broad; ocelli 16–24 in a single irregular cluster on each side of head.

- basis rather slender, or ordinary shape ; 14 proboscisial nerves ; cerebral sense organs very large . . . *A. pacificus* Coe, B', A', C', 47-97.
9. With numerous spots and blotches on dorsal surface.
Rather broad and flat ; whitish, thickly mottled with dark brown blotches and dots ; ventral surface whitish ; basis of central stylet bell-shaped. broad and flattened posteriorly ; stylets slender ; 17 proboscisial nerves
A. nebulosus Coe, A.
9. Dorsal surface without distinct spots 10.
10. Red, orange, brown, or purplish above ; pale or whitish ventrally . 11.
10. Whitish, flesh-color, yellow, or pale reddish 12.
11. With 17 to 20 proboscisial nerves ; basis of moderate proportions ; body short and broad ; dark purplish or chocolate brown above, with a

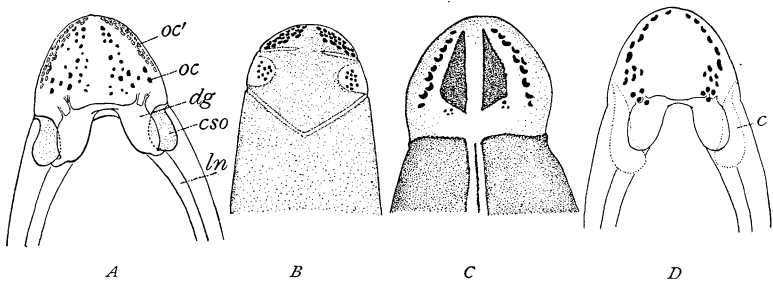


FIG. 6.—Outlines of heads, showing number and arrangement of ocelli.

A, *Drepanophorus ritleri*; *oc* and *oc'*, ocelli of dorsal and ventral surfaces of head respectively; *dg*, dorsal ganglion; *cso*, cerebral sense organ; *ln*, lateral nerve.

B, *Amphiporus angulatus*.

C, *A. bimaculatus*.

D, *A. punctatulus*; *c*, cerebral sense organ.

- triangular white spot on each side of head ; ventral surface pinkish or flesh-color *A. angulatus* (Fabr.) Verrill, B, A, P, X.
11. With 10 to 12 proboscisial nerves ; body small, rather short and broad ; reddish or orange, paler beneath ; ocelli usually only 4 to 8 on each side of head ; basis conical, stylets slender.
A. californicus Coe, S, S', 50.
12. With 10 or 11 proboscisial nerves 13.
12. With 15 proboscisial nerves.
Whitish ; very slender ; submuscular glands well developed ; intestinal cæcum short *A. paulinus* Punnett, B.
13. Small ; of moderate proportions ; whitish, pale flesh-color, yellowish, ochre, or pale orange ; ocelli commonly 10 to 50 ; basis of central stylet bell-shaped ; 10 or 11 proboscisial nerves . . . *A. flavescens* Coe, C, S.
13. Very small and slender ; whitish ; ocelli commonly 10 to 20, in four groups ; 1 to 3 accessory stylets in each pouch ; 10 proboscisial nerves
A. similis Coe, C.
14. Central stylet about three fourths as long as basis.

Body small, slender, rounded ; brownish, with minute dark brown dots ; 25 or more ocelli ; basis of central stylet bell-shaped ; cerebral sense organs large, situated close in front of brain . . . *A. fulvus* Coe, S.

14. Central stylet not more than half as long as basis 15.

15. Central stylet about half as long as basis.

Body rounded, rather slender ; color of females yellowish orange, obscured in intestinal region by dark green ova in breeding season ; males yellowish, with white flecks ; basis massive, rounded posteriorly ; cerebral sense organs in front of brain . . . *A. tigrinus* Coe, P.

15. Central stylet about one third as long as the remarkably massive basis.

Body short and rounded ; proboscis remarkably large, provided with 10 nerves ; basis larger than in any other known species, measuring about a millimeter in length and easily visible to the unaided eye ; stylets short and conical *A. macracanthus* Coe, N.

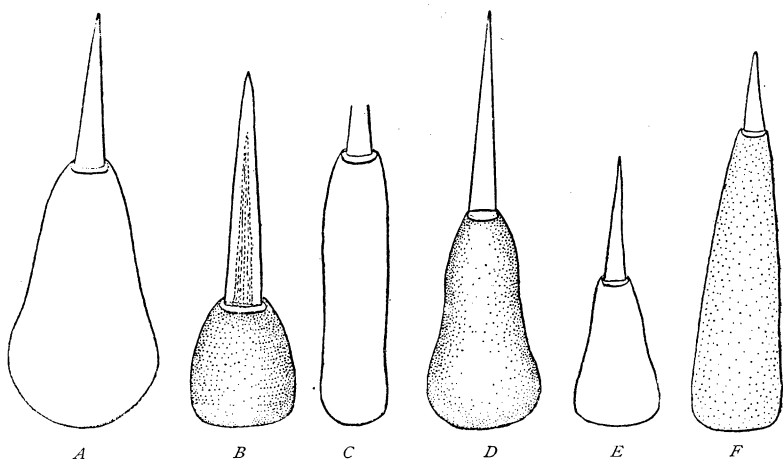


FIG. 7.—Outlines of central stylets and bases.

A, *Amphiborus formidabilis*.

B, *A. punctatulus*.

C, *A. leptacanthus*.

D, *A. californicus*.

E, *A. flavescens*.

F, *A. macracanthus*.

16. With 3 pouches of accessory stylets.

White ; body slender ; ocelli usually less than 40 ; commonly 4 to 8 nephridiopores on each side, some of which are situated on dorsal side of body *A. imparispinosus* Coe, B, A, P, C, S.

16. With 4 or more pouches of accessory stylets 17.

17. With 4 (or sometimes 2) pouches of accessory stylets 18.

17. With 6 to 12 pouches of accessory stylets.

Body very slender ; color whitish or flesh-color ; ocelli usually 60 to 250 ; commonly 20 or more nephridiopores on each side, most of which are situated on dorsal side of body . . . *A. formidabilis* Coe, B, A, P, C.

18. Orange, brownish, or reddish above, with 2 large dark brown or black

- angular spots on head ; ventral surface pale orange or flesh-color ; 14 or 16 proboscicial nerves *A. bimaculatus* Coe, A, P, C.
18. Dark brown or purplish, with small, angular white spot on each side of head ; ventral surface pink or flesh-color ; 17 to 20 proboscicial nerves ; occasionally with 4 pouches of accessory stylets
A. angulatus (Fabr.) Verrill, B, A, P, X.
19. Esophageal cæcum terminates posteriorly in front of anterior ends of intestinal cæca ; body parenchyma comparatively well developed ; ocelli few *A. rubellus* Coe, S', 20-50.
19. Esophageal cæcum extends posteriorly far beyond anterior ends of intestinal cæca ; body parenchyma but little developed ; ocelli numerous *A. occidentalis* Coe, P', 40-97.

TETRASTEMMA.

1. With 4 well developed ocelli 2.
1. Ocelli fragmented or wanting 9.

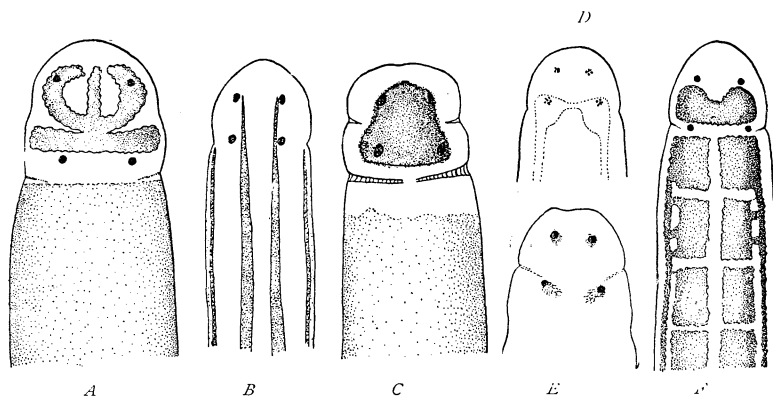


FIG. 8.—Outlines of heads, showing position of ocelli and arrangement of markings.

*A, Tetrastemma signifer.**B, T. quadrilineatum.**C, T. nigrifrons.**D, T. aberrans.**E, T. albidum.**F, T. reticulatum.*

2. Body not especially firm, somewhat flattened 3.
2. Body remarkably firm, cylindrical (CERSTEDIA.) 8.
3. With distinct longitudinal brown stripes on dorsal surface 4.
3. Without distinct longitudinal stripes of brown on dorsal surface 5.
4. Flesh-color, creamy, or grayish, with 2 deep brown longitudinal stripes on dorsal surface ; 5 to 10 mm. in length *T. bilineatum* Coe, S.
4. Whitish, with 4 deep brown longitudinal stripes, of which 2 lie on lateral margins and 2 on dorsal surface ; 8 to 12 mm. in length
T. quadrilineatum Coe, S.
5. Blood corpuscles distinctly red 6.

5. Blood corpuscles pale or colorless.

Body very slender, usually 10 to 15 mm. in length; milk-white, creamy, or flesh-colored; basis of central stylet very slender; cerebral sense organs remarkably large, situated beside brain

T. albidum Coe, C, S.

6. With large black or deep brown marking on dorsal side of head . . . 7.

6. Head without conspicuous marking.

Body 30 to 60 mm. in length; brownish red above with median white stripe; ventral surface white; without conspicuous lateral grooves on head *T. bicolor* Coe, A.

7. Cephalic marking wreath-like.

Rather slender, 15 to 25 mm. in length; reddish brown both above and below, except head which is white with a sharply marked wreath of deep brown color on dorsal surface *T. signifer* Coe, S.

7. Cephalic marking triangular or shield-shaped.

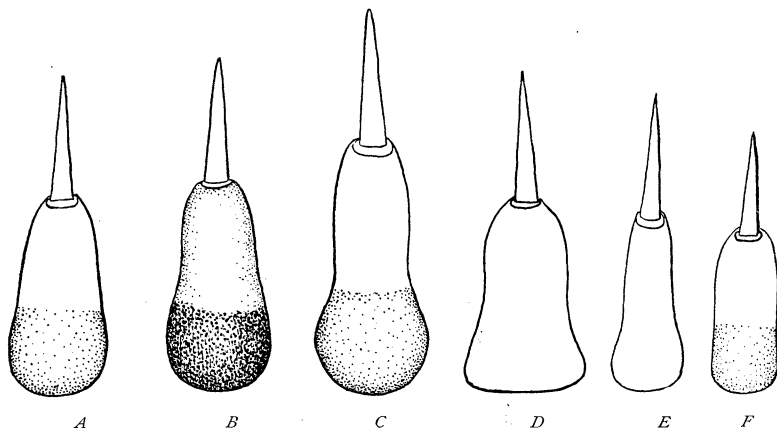


FIG. 9.—Outline of central stylet and bases.

A, *Tetrastemma signifer*.

B and C, *T. nigrifrons*.

D, *T. quadrilineatum*.

E, *T. albidum*.

F, *T. reticulatum*.

Usually 20 to 70 mm. in length; head provided with two pairs of very conspicuous, lateral, oblique furrows. Color very variable, except head which is white with shield-shaped or triangular marking of deep brown color on dorsal surface. Body deep purple, deep brown with white dorsal longitudinal band, reddish with brown flecks, pale brownish, or buff on dorsal surface; of similar color, but paler, and often with white longitudinal band, on ventral surface *T. nigrifrons* Coe, C.

8. Flesh-color or yellowish, mottled, especially on dorsal surface, with brownish blotches and dots of various shades, often mainly collected into a series of transverse bands; body slender, 8 to 15 mm. in length

T. (Ærstedtia) dorsale (Abildgaard) McIntosh, C, X, Y.

8. White, with large, rectangular and longitudinal, dark brown markings almost covering dorsal surface; often with 16 pairs of rectangular marks and pair of lateral brown lines in addition to bilobed marking on dorsal surface of head; in some varieties markings fuse together; body slender, 8 to 15 mm. in length

T. (Erstedtia) reticulatum Coe, S.

9. With four groups of fragmented ocelli.

Body usually less than 12 mm. in length; pale yellow; 12 proboscoidal nerves *T. aberrans* Coe, A.

9. Ocelli wanting; hermaphroditic.

Body 5 to 10 mm. in length; whitish or very pale yellowish; probably parasitic in Tunicates *T. cæcum* Coe, A.

DREPANOPHORUS.

Ocelli numerous, of very large size; length of body 5 to 10 cm.; dorsal surface dull reddish or orange, thickly covered with fine brownish dots; ventral surface flesh-color with tinge of orange

D. ritteri Coe, S', 50-150.

PLANKTONEMERTES.

Body broad, much flattened, gelatinous and hyaline; intestinal diverticula numerous; median dorsal vessel present; length 14 to 47 mm.; orange or pink *P. agassizii* Woodworth, E (surface).

NECTONEMERTES.

Professor Heath of Stanford University informs me that a species of this remarkable genus has very recently been collected in Monterey Bay, California. Its specific diagnosis has not yet been published.

Order Bdellonemertea.

Sucking disk present at posterior end of body; intestine coiled, without cæcum or lateral diverticula; parasitic in various species of pelecypods

MALACOBDELLA.

A single species of this genus has been recorded from California, but it has not yet been studied sufficiently to determine whether it is identical either with *M. grossa* of the eastern coast of North America and Europe or with *M. japonica* of Japan.

LITERATURE.

Although the number of species recorded from this region is so large they are all described in the following papers:—

BÜRGER, O.

- '93. Südgeorgische und andere exotische Nemertinen. *Zööl. Jahrb., Abth. Syst.*, vol. 7, pp. 207–240.

(Describes *Teniosoma (Eupolia) mexicana* from the west coast of Mexico.)

COE, W. R.

- :01. Papers from the Harriman Alaska Expedition, XX, The Nemerteans. *Proc. Washington Acad. Sci.*, vol. 3, pp. 1–110, pls. 1–13. Reprinted with the same pagination and plates in the *Harriman Alaska Expedition*, XI, 1904.

(Contains detailed descriptions of 32 species, 23 of which are illustrated by colored figures. Nearly all have full descriptions of anatomical peculiarities. There are several plates of anatomical details.)

COE, W. R.

- :04. Nemerteans of the Pacific Coast of North America, Part II. *Harriman Alaska Expedition*, XI, pp. 111–220, pls. 14–22.

(In this paper 21 species are enumerated in addition to those mentioned in the first portion of the report. These were collected mainly on the coast of California. Some 18 species are described as new to science, all except one of which are illustrated by colored figures.)

COE, W. R.

- :05. Nemerteans of the West and Northwest Coasts of North America. *Bull. Mus. Comp. Zööl.*, vol. 47, pp. 1–318, pls. 1–25.

(This report presents the results of a study of numerous collections made along the whole west and northwest coasts, from Panama to the Arctic Ocean, and in the deeper waters off the shore to a depth of several hundred fathoms. Some 27 species are recorded as new to the region, of which 24 are believed to be new to science. This brings the total number of Nemerteans thus far described from this region to 85, of each of which the more important external features and anatomical peculiarities are described. There are synoptic keys to genera and species, chapters on each of the organ-systems of the Nemerteans, their development, geographical distribution, systematic position, etc. There are 3 colored plates and 22 plates of anatomical structures.)

GRIFFIN, B. B.

- '98. Some Nemerteans of Puget Sound and Alaska. *Ann. New York Acad. Sci.*, vol. 11, pp. 193–217.

(A posthumous paper containing brief diagnoses of 12 named species.)

PUNNETT, R. C.

- : 01. Arctic Nemerteans. *Proc. Zööl. Soc. London*, 1901, pp. 90-107, pls. 6-7.

(Contains a description of one species, *Amphiporus paulinus*, from the Pribilof Islands, and mentions one other from the Commander Islands.)

STIMPSON, W.

- '57. *Proc. Acad. Nat. Sci. Phila.*, 1857, pp. 159-165.

(Three species recorded from Pacific coast.)

WOODWORTH, W. MCM.

- '99. Preliminary Account of *Planktonemertes agassizii*, a New Pelagic Nemertean. *Bull. Mus. Comp. Zööl.*, vol. 35, pp. 1-4, pl. 1.

In addition to the papers mentioned above, which contain records of the species found on the Pacific coast, many of the species which occur both there and in other regions are described and figured in Bürger's *Monograph of the Nemerteans of the Gulf of Naples*, in Joubin's monograph in the *Fauna Française*, in McIntosh's *British Annelids*, in Verrill's monograph of the New England Nemerteans in the *Transactions of the Connecticut Academy*, and in other well known works.

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